REMARKS

Claims 1, 2, and 4-6 are presently pending in the application.

Claim 3 has been canceled. Claim 1 has been amended to recite that a height of the intermediate cylindrical section is 1.5 to 4 times a diameter thereof, which is supported in the specification at least at page 8, last line to page 9, line 2. No new matter has been added by this amendment, and entry is respectfully requested.

The Examiner has again rejected claims 1-6 under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 3,409,542 of Molstedt ("Molstedt"). Briefly, the Examiner again argues that Molstedt discloses a process of discharging and transferring upwardly fluidized particles from a dense fluidized layer forming section to an upper section having a diameter that is smaller than the dense fluidized layer forming section, wherein an intermediate cylindrical section (cone) is provided between the dense fluidized forming section and the upper section. The Examiner estimates that the height of the intermediate section is 1 to 6 times the diameter thereof. Molstedt allegedly teaches that the intermediate section has truncated cone ends connected to the dense fluidized layer forming section and the upper section, respectively, the former having an elevation angle of 60°.

In response to Applicants' previous argument that Molstedt teaches a far greater gas velocity at the tapered zone of 25 to 100 ft/s, in contrast with the claimed superficial gas velocity of about 0.9 to 7.2 m/s, the Examiner argues that Molstedt teaches the velocity at the <u>tapered zone</u> of 25 to 100 ft/s, not the velocity of the <u>intermediate section</u>.

Applicants previously argued that there would have been no motivation based on Molstedt to lower the gas velocity in the intermediate section. The Examiner acknowledges that Molstedt does not disclose that the velocity in the intermediate cylindrical section is about 0.9 m/s to 7.2 m/s but takes the position that the process of Molstedt utilizes a velocity within the claimed range in the dense bed and that the modified intermediate section of Molstedt is similar to the claimed intermediate section. Therefore, the Examiner concludes that the velocity in the intermediate section of Molstedt would be similar to the claimed velocity.

Finally, Applicants previously argued that Molstedt does not recognize that the change in the pressure drop is mainly caused by the structure of the intermediate section and thus there would have been no motivation to change the elevation angle in such a section. In response, the

Examiner argues that the gas velocity within the intermediate section would be the same or similar when using either a shorter-pipe intermediate section with an elevation angle of about less than 85° or a longer-pipe intermediate section with an elevation angle of 85° or greater.

Applicants respectfully traverse this rejection and the arguments in support thereof as follows for the reasons set forth previously on the record, which Applicants rely upon in full, and for the additional reasons which follow, and respectfully request reconsideration and withdrawal of the rejections.

As previously explained and described in the Background section of the present application, in the surface of the dense fluidizing layer in fluid catalytic cracking (FCC) devices, clusters of particles jump from the surface when bubbles rising through the layer rupture. The clusters then break up, and part of the cluster descends and part rises. In a relatively short freeboard (upper space), as in traditional devices, the clusters cannot break up completely, even if the upper portion of the dense fluidizing layer forming section is formed into a truncated cone. Therefore, clusters can pass through the upper portion and reach the high velocity transferring section. As a result, the amount of transferred particles varies and pressure loss occurs.

In contrast, according to the present invention, an apparatus used in a process of discharging and transferring fluidized particles contains an intermediate section having an elevation angle of 85° or greater which is provided between the dense fluidizing layer forming section (the reactor) and the high-velocity transferring section (the riser). In a structure with such an intermediate cylindrical section, the rising rate of a mixture of fluidizing gas and particles (catalyst) is relatively less than that through a tapered section. Accordingly, the residence time of the mixture in the section becomes longer and the clusters of the particles (catalysts) which have been generated in the reactor can fully break up while rising through the section, so that the particles are uniformly dispersed in and rise uniformly with the fluidizing gas. Therefore, use of the apparatus in the claimed method decreases variations in the quantities of particles to be discharged from the reactor and transferred to the riser, as well as changes of pressure in the riser, making it possible to smoothly and stably transfer the particles through the system without clogging the cyclone separator or the particle down-flow circulating line.

In the presently claimed invention, an intermediate section is formed into a substantially cylindrical shape and the superficial gas velocity is about 0.9 to 7.2 m/s, whereby the cluster of

particles from the reactor fully breaks up while rising slowly therethrough. The particles can thus reach the riser in a uniformly dispersed state, as described at page 10, line 19 through page 11, line 4 of the specification. That is, due to the substantially cylindrical shape of the intermediate section and the specific gas velocity therein, the cluster can be maintained in this intermediate section for a sufficient period of time until the cluster fully breaks up. In other words, allowing the cluster to transfer up to the riser at the very slow claimed velocity of about 0.9 to 7.2 m/s allows the cluster to be sufficiently broken up, resulting in the uniform dispersion of the particles into the gas. As a result, the change in the quantity of particles which is discharged from the reactor and transferred to the riser and the pressure change in the riser both decrease, and thus the particles are circulated smoothly.

The advantageous effects of the present invention obtained by employing the specifically designed intermediate cylindrical section are specifically shown in the Example at pages 11- 13 of the specification. In this experiment, the intermediate cylindrical section (13) has a completely cylindrical shape (elevation angle 90°) and a diameter of 2.6 cm (Dp). The experimental results show that the average pressure change in the riser was small (ΔP_R = 78.4 Pa (8 mmaq)) and that the observed particles in the riser were uniformly dispersed into the gas and rose through the riser, so that the particles circulated smoothly from the separator (16) to the particle-down-flow circulating line (17) without clogging.

The claimed intermediate cylindrical section has a height that is 1.5 to 4 times its diameter and is a longer pipe intermediate cylindrical section with an elevation angle of 85° or greater. In the Inventive Example, the ratio (Hp/Dp) of the height (Hp) to the diameter (Dp) of the intermediate cylindrical section is 3.8 (page 11 of the application). The claimed relative dimensions of the intermediate cylindrical section are so designed that clusters of particles rising from the surface of a dense fluidizing layer can be broken up finely enough through the intermediate cylindrical section to reach a riser in a uniformly dispersed state in the gas.

That is, by setting the height/diameter of the intermediate cylindrical section to the specifically claimed ratio, large clusters from a dense fluidizing layer can stay in the cylindrical section until they fully break up therein. Then, due to their repeating descent and ascent motions within the section, the clusters keep on breaking up and then gradually become fine enough to be

conveyed against their own weights to the riser, even at a slow gas velocity of about 0.9 to 7.2 m/s. As a result, the fine clusters can reach the riser in a uniformly dispersed state in the gas.

Applicants respectfully traverse the Examiner's conclusions that: (a) the gas velocity within the intermediate section would be the same or similar when using either a shorter pipe intermediate section with an elevation angle of about less than 85° or a longer pipe intermediate section with an elevation angle of 85° or greater; (b) since the modified process of Molstedt is similar to the claimed process in terms of gas velocity within the dense bed and the intermediate section, it would be expected that the velocity in the intermediate section of Molstedt would be similar to the claimed velocity; and (c) Molstedt teaches the velocity at the tapered zone of 25 to 100 ft/s, not the velocity of the intermediate section.

To the contrary, Molstedt teaches in col. 3, lines 71-75 that the superficial gas velocity within the dense phase fluid bed is about 0.3 to about 2.0 ft/s (0.09 to 0.6 m/s) and the gas velocity increases at the top of the tapered zone to 25 to 100 ft/s (7.6 to 30.5 m/s). Molstedt also teaches a shorter-pipe intermediate section with an elevation angle of about less than 85°, making the section tapered and thereby increasing the gas velocity (i.e., the section is formed to accelerate the gas movement). In practice, Molstedt's process is implemented by using an intermediate section in which the tapered sections provide for increasing the gas velocity from about 1.0 ft/s (0.3 m/s) in the dense phase fluid bed to about 75 ft/s (22.8 m/s) at the outlet of the upper cone (Molstedt col. 3, lines 65-70 and col. 5, lines 48-51).

In contrast, the claimed gas velocity in the intermediate cylindrical section is maintained at a constant velocity of about 0.9 m/s to 7.2 m/s <u>and thus is not accelerated</u>. Indeed, in the inventive Example of the present application the gas velocity (Up) in the intermediate cylindrical section is constantly 1.25 m/s. The gas velocities at the reactor (Uo) and riser (U_R) are 0.33 m/s and 7.0 m/s, respectively and are also kept constant. Of course, at the truncated cone ends connected to each of the reactor and riser, the gas velocities should be accelerated. Therefore, the claimed intermediate cylindrical section clearly differs in its shape from that of Molstedt and the gas velocity within the claimed intermediate cylindrical section also differs from the gas velocity in the Molstedt intermediate section.

Further, the process taught by Molstedt fails to provide for the smooth circulation of particles in the entire system, including the riser. Specifically, when the intermediate section is a

shorter-pipe intermediate section with an elevation angle of about less than 85° and the process is carried out under the condition that the gas velocity within the section is increased up to at least about 25 ft/s (7.6 m/s) at the outlet of the upper cone, the large clusters rising from the dense fluidizing layer are conveyed to the riser without being fully broken into fine clusters. As a result, the clusters are unevenly dispersed in the riser and thus cause the pressure change in the riser to increase, thereby preventing the particles in the system from circulating smoothly.

In order to prove that the process and apparatus of Molstedt cannot achieve the dispersion of the clusters within the intermediate section as intended by the present invention, Applicants have conducted an additional comparative experiment using the method described in the present application to compare the claimed and Molstedt apparatuses. This experiment is described in the Declaration Under 37 C.F.R. § 1.132 of Yuichiro Fujiyama ("Fujiyama Declaration"), submitted herewith. As seen in the apparatus shown in the figure of Molstedt, the tapered zone is composed of three successive tapered sections which form the lower, middle, and upper cones, respectively. Element 4 in the middle cone indicates an interface with a wavy line between the dense phase zone and the dilute phase zone 5. Therefore, it is Applicants' understanding that the middle cone of Molstedt corresponds to the intermediate cylindrical section (13) of the inventive apparatus shown in Fig. 1 because within both sections, the descending and ascending of the clusters are always repeated at each interface. Further, it is Applicants' understanding that the lower and upper cones of Molstedt correspond to the lower and upper truncated corners (12) and (14) respectively, of the inventive apparatus.

For these reasons, as explained in paragraph 6 of the Fujiyama Declaration, the comparative experiment was carried out using an apparatus constructed by replacing the intermediate cylindrical section (13) of the inventive apparatus shown in Fig. 1 of the present application with the middle cone shown in and described by Molstedt. As described in paragraph 6 of the Fujiyama Declaration, when the height-to-diameter ratio (Hp/Dp) (in this case, the ratio of a half height of the middle cone to the diameter at that height), is calculated from the drawing of Molstedt, it is about 1.0, which deviates from the claimed ratio of Hp/Dp = 1.5-4. Using this comparative apparatus, the average pressure change in the riser portion (ΔP_R) was 115.6 Pa, dramatically greater than the value obtained using the claimed apparatus (78.4 Pa).

Attached to the Fujiyama Declaration (page 4) are photographs of the dispersed states in the gas of the clusters of the particles within the middle cone intermediate section in the comparative and inventive apparatuses. As described in paragraph 7 of the Fujiyama Declaration, the upper photograph of the comparative (Molstedt) apparatus shows that the clusters of the particles rising from the surface of the dense fluidizing layer were transferred to the lower portion of the riser as they were insufficiently dispersed in the gas. This is because the clusters were accelerated within the tapered sections to reach at least 7.6 m/s of gas velocity at the outlet of the upper truncated cone, resulting in sharp rising through the tapered sections before the clusters were sufficiently broken up. As a result, an unevenness in concentrations of the cluster in the riser arose, thereby increasing the pressure change in the riser.

In contrast, considering the lower photograph (inventive apparatus), the large clusters rising from the surface of the dense fluidizing layer were able to stay in the intermediate cylindrical section until they were fully broken up and became fine enough to be transferred against their own weights to the riser, even at a slow gas velocity of approximately 0.9 to 7.2 m/s. As a result, the clusters were able to reach the riser in a uniformly dispersed state in the gas, and thus the pressure change in the riser became stable at a relatively low level.

It is apparent from the results described in the Fujiyama Declaration and the photographs attached thereto and described therein that the apparatus and process of Molstedt <u>could not</u> provide the clusters of particles within the intermediate section with a preferably dispersed state, as is achieved by the presently claimed process and apparatus used therein. In the claimed process, the gas velocity in the intermediate cylindrical section is kept constant within the claimed range, and this section is adjusted so that the height/diameter ratio is 1.5 to 4. Accordingly, the physical attributes of the intermediate section are critical to providing the observed properties. Such properties, as demonstrated in the Fujiyama Declaration, would not have resulted from the Molstedt apparatus.

For these reasons, the presently claimed invention would not have been obvious based on Molstedt and reconsideration and withdrawal of the §103(a) rejection are respectfully requested.

In view of the preceding Amendment, Remarks, and Fujiyama Declaration, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

Yoneichi Ikeda et al.

October 1, 2007 By: W. W. Schwarze, Reg No. 25,918
(Date) for

SANDRA M. KATZ
Registration No. 51,864
AKIN GUMP STRAUSS HAUER & FELD LLP
One Commerce Square
2005 Market Street, Suite 2200
Philadelphia, PA 19103-7013
Telephone: 215-965-1200
Direct Dial: 215-965-1344
Facsimile: 215-965-1210
E-Mail: skatz@akingump.com

SMK:smk

Enclosure – Petition for Extension of Time (one month)
Request for Continued Examination (RCE)
Declaration Under 37 C.F.R. §1.132 of Yuichiro Fujiyama